11-2019

Examining learning transformation in project-based learning process

Gary PAN
Singapore Management University, garypan@smu.edu.sg

Poh Sun SEOW
Singapore Management University, psseow@smu.edu.sg

Grace KOH
Singapore Management University, gracekoh@smu.edu.sg

DOI: https://doi.org/10.1108/JIEB-06-2018-0022

Examining Learning Transformation in Project-based Learning Process

Gary PAN[1]
School of Accountancy
Singapore Management University
60 Stamford Road, Singapore 178900
Garypan@smu.edu.sg

Poh-Sun SEOW
School of Accountancy
Singapore Management University
60 Stamford Road, Singapore 178900
psseow@smu.edu.sg

Grace KOH
SMU-X
Office of Provost
71 Stamford Road
Level 3, SMU Labs
Singapore 178895
gracekoh@smu.edu.sg

Abstract

This paper[2] presents a learning transformation framework for analyzing how learning evolves during project-based learning process. Here we adopt Lewin's (1951) change theory as an analytical lens to examine the project-based learning curriculum at a University called UNI-X. This is a major contribution to PBL literature as little is known about the dynamics of learning during PBL process. In fact, the learning transformation framework can serve as the basis for further research in PBL process. For educators, this study provides them with useful insights on how to break project members' escalating commitment to previous failing ideas and accept alternative workable ideas. Educators can utilize the framework in post-mortem analyses of projects to devise useful actions for facilitating learning transformation during PBL process.

Keywords: Project-based Learning, Learning Transformation, Lewin's Change Theory.

---

[1] Corresponding Author.

[2] This research is funded by Singapore's Ministry of Education Tertiary Education Research Fund (MOE-TRF) Accepted Research Proposal: 'Evaluating SMU-X Pedagogy: An Innovative Approach to Prepare University Students with Future Work Skills'.

Examining Learning Transformation in Project-based Learning Process

Significant economic shift has exerted substantial pressure on universities worldwide to evolve and respond to new human capital demands of industries and workplaces. Specifically, universities have been asked to rethink pedagogy for learning the twenty-first century competencies that encompass creativity, problem solving, teamwork and adaptability. The shift in pedagogy from traditional learning approach to a more inquiry-based learning method such as project-based learning (PBL) (Bell, 2010), is to better prepare students to be future-ready working professionals. Parker, Mosborg, Bransford, Vye, Wilkerson and Abbot (2011) show that PBL pedagogy results in deeper conceptual learning and PBL students tend to perform as well or better than students taught in traditional pedagogy. Mergendoller, Maxwell and Bellisimo (2006) concur PBL is more effective compared to traditional learning method.

Developing twenty-first century competencies requires taking what was learned in one situation and applying it to new situations. According to Silva (2009), proponents of twenty-first century learning point to a "new workforce reality" that demands the next generation of graduates to be "independent thinkers, problem solvers, and decision makers" (p.630). Silva (2009) argues that the essence of twenty-first century competencies is emphasizing what students can do with knowledge, rather than what units of knowledge they have. Rotherham and Willingham (2010) also argue that advocates of twenty-first century competencies favour student-centred modes of learning, such as project-based learning, which allows students to "collaborate, work on authentic problems, and engage community" (p.19).

Essentially, PBL allows learners to immerse in real-world experiences with sustained engagement and collaboration; engage in detailed research, enquiry and analysis; and communicate effectively to audiences (Barron & Darling-Hammond, 2008). Such learning

approach may contribute to learners' subject-matter knowledge, problem-solving skills, teamwork and self-directed learning (Cole, Barker, Kolodner, Williamson, Wright & Kern, 2004). It gives learners more freedom to explore ideas, as well as opportunities to demonstrate problem-solving skills and creativity.

While PBL plays an important role in learning the twenty-first century competencies, little is known about how learning takes place during PBL process. In particular, the change process of how learners experiment new ideas, explore alternative ideas and come to a consensus to accept new ideas in a collaborative project setting. For PBL process to work effectively, learners ought to maintain an informal atmosphere, encourage everyone to participate in discussions, define clear objectives, listen to one another, reach decisions by consensus, allow disagreement and make clear assignments.

This paper draws upon Lewin's (1951) theory of change to examine learning transformation during PBL process. We view Lewin's theory as an appropriate analytical lens for this study because in many 'learning entrapment situations', there are competing forces of change which may encourage persistence or abandonment of an idea (Teger, 1980). The concept of 'unfreezing-changing-refreezing' helps to analyze these competing forces of change which tend to create a conflict over the decision to continue or withdraw from a learning entrapment situation.

The remainder of the paper is organized as follows: we first explain the concept of project-based learning and outline how Lewin's theory of change can act as a theoretical lens to make sense of learning transformation during PBL process. This is followed by the description of a case study conducted between April 2016 and March 2018 where we examined a set of PBL courses that were developed and taught in a university called UNI-X (a pseudonym). In these PBL courses, students from various disciplines formed project teams and applied their inter-disciplinary knowledge in developing implementable solutions to address

real-world issues and challenges in various organizations. Lewin's change framework is used to identify and analyze how and why students in project teams surrendered their original ideas and collectively agreed to new ideas. The framework represents a useful analytical model that could organize the learning transformation process into three stages: unfreezing, changing and refreezing. The paper concludes with implications, future research and limitations.

Theoretical Foundation

Project-based Learning

According to the Buck Institute for Education (2015), PBL is an inquiry-based instructional approach to learning where "students gain knowledge and skills by working for an extended period of time to investigate and respond to an engaging and complex question, problem, or challenge." PBL can be defined as "a systematic teaching method that engages students in learning knowledge and skills through an extended inquiry process structured among complex, authentic questions and carefully designed projects and task" (Markham, Larmer, & Ravitz, 2003, p. 4). The outcome of PBL is greater understanding of a topic, deeper learning, higher-level reading, and increased motivation to learn (Raghavan, Coken-Regev & Strobel, 2001). PBL may increase student interest and engagement in school as the learning approach appears to improve the attendance rates of students. It leads to more of economically disadvantaged students attending school on a more regular basis and actively striving toward graduation (Creghan and Adair-Creghan, 2015).

Typically, PBL challenges students to use their disciplinary knowledge and skills to tackle real world problems and issues through inter-disciplinary approaches and activities. Repko (2008) suggests that interdisciplinary learning helps students to advance their critical thinking and cognitive development. According to Ertas, Maxwell, Rainey and Tanik (2003), inter-disciplinary forces one to "think across, beyond, and through the academic disciplines to encompass all types of knowledge about an idea, issue, or subject (p. 289). This confluence of

disciplinary power offers possibilities for richer and deeper student learning. From graduate capabilities and outcomes, to creation of diverse knowledge bases, inter-disciplinary teaching enhances the development of creative and practical skills that enables application across industries and practices (Devlin, 2008).

Students learn accountability with PBL as the group dynamic creates an interdependent team in which students must each do their part, and as a result, a natural consequence exists for those students who do not demonstrate accountability (Rotherham & Willingham, 2010) – others may no longer want to be paired with students who fail to do their fair share. One way of staying on task during PBL is by conducting brief daily meetings that give students working in groups the structure to hold each other accountable on the project (Edutopia, 2015). Apparently, peer pressure may contribute to the accomplishment of ongoing group tasks throughout the learning process and the culmination of a successful final product. Accountability to peers often has greater consequences and provides more motivation for students than if they were only responsible to instructor.

PBL promotes social learning as students practise and become proficient with the twenty-first-century skills of communication, negotiation, and collaboration (Eggen & Kauchak, 2001). As they work on these projects, they brainstorm ideas and act as good listeners to their group members. Teaching students active listening skills enhances teamwork as well as creativity (Zhou, 2012). Students learn the fundamental skills of productive communication, and respect for others, while generating ideas together. Negotiating how to collectively solve a problem is also a part of PBL. Evidence exists that through PBL, students become better researchers, problem solvers, and high-order thinkers (Gultekin, 2005). Students retain more information when they learn by doing. Dewey (1938) proposes that learning by doing has great benefit in shaping students' learning. Lee, Blackwell, Drake and Moran (2014) also found that using client-based projects helps to motivate students and results in more effort and

commitment from students. According to Activate Learning (2015), students are engaged as active learners by investigating questions relevant to their lives. Such learning process involves collecting and analyzing data; developing and using models to explain phenomena, and engaging in argument from evidence.

While individuals can get a task work done alone, the ability to interact effectively with others is often acquired through exposure to different group work experiences. These abilities are highly valued because it is transferable across different professional domains (Marks, Mathieu & Zaccaro, 2001). Learning in a group also has its advantages compared to individual learning. Groups have greater amount of information compared to an individual. Assuming group members' knowledge, skill and ability are not completely redundant; groups have a greater pool of information compared to individuals (Hinsz, Tindale & Vollrath, 1997). As there are diversity in knowledge and skills, individuals working in groups can learn from each other, which maximizes each individual's learning opportunities.

While PBL has many benefits, Aslan and Reigeluth (2015) highlight two major challenges in implementing such learner-centred approach: (1) changing students' mind-set from a traditional teacher-centred learning experience to a self-directed learning paradigm; and (2) teachers may need help in identifying ways and setting criteria in awarding credits to decrease subjectivity in determining mastery.

In summary, our review of the PBL literature highlights a knowledge gap. Exactly how learning is transformed and whether any intervention action is required to effect change during PBL process remains largely unaddressed.

Adapting Lewin's Theory of Change

To achieve our objective in this research, we adapted Lewin's (1951) theory of change as a theoretical lens to help us better understand learning transformation during PBL process. Lewin's (1951) theory of change can be used as a lens to conceptualise the inertias and enablers

of how learners experiment new ideas, explore alternative ideas and eventually come to a consensus to accept new ideas in a collaborative project setting. Generally, the theory evolves around a basic change model of unfreezing, changing, and refreezing. The model perceives human change as a 'profound psychological dynamic process that involves painful unlearning without loss of ego identity, and difficult relearning as one cognitively attempts to restructure one's thoughts, perceptions, feelings, and attitudes' (Schein, 1996, p. 27). The model assumes that the change involves learners' attitudes and values, and the unlearning of the present set of ideas and behaviours is initially inherently painful. In addition, the model also suggests change as a multistage process and all stages must be negotiated before a stable change can take place (Schein, 1988). Applying Lewin's theory of change to examine how learning may change during PBL process serves to plug the gap in the PBL literature.

Figure 1 shows Lewin's stages and steps - a learning transformation framework we adapt for guiding our study. The framework suggests that unfreezing can only take place when there is motivation to change, and such motivation could either be self-induced or influenced by peers. Unfreezing tends to generate a certain extent of psychological struggle within individuals, which can often be inherently painful. The change process involves the development of new ideas based on new information and cognitive redefinition. Generally, learning takes place during the changing phase. Refreezing, it is believed, can only begin when new ideas are adopted. Finally, before relearning stabilizes, there must be successful alignment and integration with individuals' values and beliefs.

Research Approach

Our strategy was to undertake in-depth case research of PBL courses developed and taught in UNI-X. The case study approach is particularly appropriate for our exploratory study

since it allows us to capture the organizational dynamics of the phenomenon better and also its ability to explain the phenomenon based on interpretation of data.

From April 2016 to September 2017, we conducted our data collection. We were able to capture how learning transforms in these PBL courses. Primarily, focused group interviews were conducted with 28 students, 12 faculty and 5 industry project sponsors asking specifically their perceptions of PBL's course design, delivery and its impact on overall student experience. These student interviewees were undergraduate students who had completed at least one PBL course. These focus group interviews were taped-recorded with interviewees' permission and transcribed immediately after the meetings. Each focus group interview lasted at least two hours. Focus group interviews were the main source of our data because the researcher could grasp the interviewees' interpretations of their own project experience, as well as their beliefs in the projects. Secondary data such as reports were also gathered to supplement the information collected through these interviews. Overall, the data collection process drew upon interviewees' perceptions of PBL's impact on student experience in learning future work skills.

In terms of data analysis, we recursively iterated between the empirical data, the theoretical lens, and the PBL literature. The iteration helps to shape our findings. We continued with the iterative process until it is possible to comprehensively explain the findings of the phenomenon we study, and no additional data were needed to be collected to improve the interpretation of the findings. Our analysis includes reading all transcripts and documents, highlighting the descriptions and developing a list of relevant themes.

To establish the reliability of data coding, each coder was asked to code a particular segment of the relevant texts. Coding was conducted independently and without consultation and guidance. We measured the inter-coder reliability. Once we established a high reliability coefficient, each coder was subsequently asked to code separate portions of the texts. Relevant interview comments and secondary reports were sorted based on the various categories and a

list of themes within each category was developed. The list contained the location of each comment on the transcript, the transcript number, the interview date, any links to other comments and reports. A coding scheme was created to establish high inter-coder reliability, and the coders were blind to condition (groups) of participants.

Project-based Learning Pedagogy at UNI-X

Recognizing the need to prepare its students with twenty-first century competencies so as to tackle increasingly complex real-world problems, UNI-X launched undergraduate courses that adopt a PBL pedagogy.

The PBL pedagogy at UNI-X comprises four principles: i) project-based learning tackling real world problems and issues; ii) inter-disciplinary learning; iii) active mentoring and; iv) a deeper relationship between faculty, student and industry partner. By applying the 4 principles in a project, students are expected to learn competencies such as critical and inventive thinking; communication, collaboration and adaptability. By weaving these four principles together in a closely knitted manner, PBL offers a fundamental platform for students to learn and share knowledge.

As each PBL course involves partners from corporate, non-profit or government-sector organisations in project design, it is built into the course that the partners and faculty actively mentor so that students benefit most out of the deep relationship. A key benefit of close engagement with external partners is to provide authentic feedback on student projects. In addition, students could better see the applicability of the course to their future careers with client-based projects. Essentially, a PBL course establishes a learning loop for the tripartite: students obtain a deeper understanding of what it means to apply theory learnt outside the classroom, faculty learns how real world adapts theory and external partners deepen their own learning methodology.

As at December 2017, there are 38 PBL courses at UNI-X. The enrolment for these PBL courses reached 4466 places between 2015 and 2017. To date 3385 undergraduate students have studied at least 1 PBL course with 811 students studied 2 or more PBL courses. These PBL courses have collaborated with more than 259 organizations that sponsored projects, and students taking such PBL courses have delivered more than 700 implementable solutions to these organizations.

Types of PBL projects at UNI-X include accounting, branding, business improvement, data analytics, design thinking, innovation, policy implementation, smart technologies, strategic management and web/mobile application development. Out of the 259 partners, 70% are private companies, 14% are public companies and 16% are NGO. Among the private companies, 32% are multi-national companies, 7% are large local companies and 61% are SMEs. Top 3 industries are Information and Communication, Health and Social Sciences, and Wholesale and Retail Trade.

Results and Discussion

We know that learning transformation during PBL process is a complicated process and learners play key roles in embracing and facilitating learning. So understanding the process of how learning changes and could be better facilitated becomes important for PBL to be effective. By applying the steps provided by the framework shown in Figure 1, we analyze in the following section how learning is transformed during PBL process. Our findings indicate that the change in learners' beliefs was planned and intentional, initiated by the change agent, the instructor, who consciously set out to establish conditions and circumstances that were different from the earlier stages of the project and then accomplished these through a series of actions and interventions.

Stage 1: Unfreezing Belief in Previous Ideas

Schein (1996) suggests that unfreezing basically involves three processes: (a) disconfirmation of expectations, (b) induction of learning anxiety if the disconfirming data are accepted as valid and relevant, and (c) provision of psychological safety that converts anxiety into motivation to change. Schein (1996, p.29) also highlights the issue of learning anxiety, "if we admit to ourselves and others that something is wrong or imperfect, we will lose our effectiveness, our self-esteem, and maybe even our identity." Lewin (1951) views that equilibrium would change more easily if restraining forces such as personal defences and group norms were unfrozen. The overall presumption is that change would occur during periods of divergence when entities are moving away from their equilibrium conditions (Weick & Quinn, 1999).

Identified expectation gap in project among students, faculty and project sponsor. In PBL courses at UNI-X, one of students' major concerns for projects was always about meeting expectations of project sponsors and instructors whenever an expectation gap exists, this might imply the need for project direction to be disconfirmed and even re-directed. It is therefore important for students, instructors and project sponsors to co-define goals and benchmarks for the project, (e.g., by co-constructing assessment rubrics) guided by desired outcomes. In the case of UNI-X, project sponsors are typically involved prior to the start of the course in discussion with the instructors, to collaborate, align course with industry expectations and ensure the pedagogical approach (knowledge, skills & behaviour) meets their needs. A project sponsor stated:

> "One of the biggest challenges for students is to develop a solution that is practical, workable and something which could relate to the business issue. Making students understand and see this objective is most important during the project scoping and at the start of the project."

Typically, students would clarify their project goals with their instructors and industry project sponsors, by having meeting prior to or at the start of the project. The instructors in the PBL courses play an instrumental role in identifying gaps in the expectations among the project stakeholders. Instructors are expected to intervene and send clear signals to the project group if they fail to live up to hers or project sponsors' expectations.

Undertaken intervention to induce anxiety and discomfort to challenge the strong belief. In PBL courses at UNI-X, students understand there is no single "right answer" or preferred way to do the project. In fact, they are constantly reminded and challenged by instructors to 'think out of the box' when developing ideas and solutions. Intentionally, instructors do not "frontload" too much information at the start of the project, but wait until it is needed or requested by students. According to a final year business student who has taken a PBL course:

> "We have learnt to deal with uncertainty and ambiguity and also learnt to listen to other project members' ideas. More importantly, we were often reminded to always think outside the box and come up with unique ideas to achieve our project objectives."

Our data suggest that when project members were told to give up their commitment to a failing idea or commit to a project redirection, there was always a sense of anxiety among the project members. This could be attributed to the fact that failure is viewed as a negative emotional response which has been found to interfere with individuals' allocation of attention in the processing of new information (Shepherd, 2003). This confirms an earlier finding that providing support may be important during project development (Heng, Tan & Wei, 2003). According to a PBL instructor:

> "We shared with students the values of critique and revision, persistence, rigorous thinking, and pride when doing high-quality work."

A student also commented:

> "I was mentored to deal with uncertainty, ambiguity and anxiety, and that there are no perfect answer to open-problems. But still, you have to try your best to find the best solution. I also learnt that what matters is not the originality of your idea but rather if it is strongly feasible. I experienced a hard time when managing this project but I was really happy with the takeaways I received from this course, and I was also proud of the final project outcome."

A student from School of Social Sciences described in her case how she sought meaning, reflected on what had been learnt, and internalized knowledge by creating personal understanding.

> "What I took away from this course is that every idea is worth a second thought, and we were reminded frequently not be so quick to put down or thrash ideas. I have also learnt the importance of and the proper way to brainstorming, which I feel is very useful in any situation."

Our data suggest that students held one another accountable for the project progress and outcome. Students regularly self-assess their progress and, when appropriate, assess peers on their performance. Assessment rubrics were used by students to guide both formative and summative assessment, and to guide students to deeper levels of thinking. Students gave and received constructive feedback to inform learning decisions and actions. An accountancy student highlights the positive effect on the learning attitudes in the PBL course she took:

> "Our project scope was clear, but our group's realization of certain aspects along the way, needed to make and accommodate changes, made the project more realistic as compared to fixed-frame, standardized projects.

Being evaluated by an actual client also meant that dynamic changes were needed whenever feedback was provided."

Provided assurance and support. It is important to create, support and model a safe learning environment where students feel valued, trusted and respected during the learning process. Reframing conflicts and difficulties in a positive light, shows faith in students and exudes enthusiasm for the learning process (Oakley, Felder, Brent & Elhajj, 2014). All students received necessary instructional supports, which were progressively removed when no longer required. A flexible schedule was arranged to minimize business interruptions to industry partners, and which allows companies to provide more learning opportunities for students. Active mentoring from instructor was also sought so that students could contribute to better business relationships with the industry partners.

Our data suggest that students' anxiety in projects was relieved when instructors provided the necessary endorsement and 'safety net' over the project development. Students also identified the assurance of no recrimination was vital in project team, since previous research has suggested the importance for managers to reduce the severity of penalties for failure to avoid risk taking in projects. The creation of psychological safety helped to encourage project members to take risk and participate actively in project development. Furthermore, project members were adequately motivated not only to participate in the discussions, but more importantly, to devise a useful alternative project idea or direction. Our finding is consistent with existing research that suggests one of the ways to instil motivation and enthusiasm in project members is to provide adequate assurance (Heng, Tan & Wei, 2003).

Stage 2: Changing Previous Beliefs and Attitudes

Previous research (Prochaska, DiClemente & Norcross, 1992) suggests that when people are exposed to change interventions, they are at one of four stages: precontemplation, contemplation, action and maintenance. Weick and Quinn (1999) also suggest that change is

not a linear movement through the four stages but a spiral pattern of contemplation, action, and relapse and then successive returns to contemplation, action, and relapse before entering the maintenance stage. Huber and Glick (1993) suggest that the triggers of change come from at least five sources: the environment, performance, characteristics of top managers, structure, and strategy. In many situations, people develop new ideas by identifying with a role model or scanning the environment for information relevant to change (Schein, 1988). Here, the role of the change agent is that of prime mover who creates change. The logic of attraction suggests that when leaders make deep changes in themselves, they will behave differently toward their immediate subordinates, and the new behaviours in the leader would attract new behaviours from followers (Spreitzer & Quinn, 1996).

Instructor introduced cognitive restructurings and semantic redefinitions. In the case of UNI-X, students were frequently challenged to innovate as they did not have a precedent which they could refer to and the questions that they faced while doing the project were largely things they could not easily find in textbooks or from classroom learning. Thus, students learnt to take initiative and conducted research on their own. Performance expectations were clearly established and shared with students by instructors. Students' engagement and ownership of projects were driven by the shared responsibilities of the project work among project members. Intervention by instructor occurred in situations when student groups lacked the skills to deal with obstacles they encounter in projects. Once students were guided with the necessary skills and knowledge, the instructor then stepped back and continued to serve as a resource person, cheerleader, and facilitator (Schwartz, 2013).

Consulted various stakeholders to explore alternative ideas. In the PBL courses at UNI-X, the challenge for instructors was to neutralize the tendencies of both project lead and the project group to persist with a failing idea. Groups tend to induce stereotyping, decrease ownership of ideas, and are less willing to express unique thoughts (Royer, 2003). Interventions

as such, rely more on gathering data from the environment and sharing them widely across the project team. According to a project sponsor:

> "The close interaction with students has provided us the opportunity to learn new ideas and knowledge. At the same time, students get to learn and consult us on a regular basis. Over time, the working relationship evolved from a mentor-mentee relationship to one of a friendship."

A student that took in PBL course in Economics overcame a tendency to maintain preconceived ideas which resulted in a broader understanding of the issues commented:

> "I have learnt to pick up essential skills in eliciting responses from people on the ground, as these people provide useful insights to the effectiveness of policies, identifying the loopholes, rooms for improvement, and what policies had been implemented well."

Another student commented:

> "Convincing your teammate is always difficult in terms of skill and effort. Working in an interdisciplinary team is difficult and proper delegation of roles is essential first step for any team. In the project, we were mindful of each other becoming more entrenched in our own way of thinking and be closed off to other viewpoints. Cross functional teams are only powerful if project members are reminded that opposing viewpoints are not necessarily wrong."

Scanned the environment for information. In PBL projects at UNI-X, it is clear changes in the beliefs of the students during the project, went through a series of cognitive restructurings and semantic redefinitions, and seeking alternative sources of opinions and information for new ideas. Students, instructors and project sponsors cooperated and worked toward a common goal. The end result was the adoption of an alternative idea and solution,

which could modify the project direction without causing significant changes to its original specification. It is important to highlight the important role played by instructor in instilling coordination and commitment of the new project direction within the project group.

Stage 3: Refreezing New Beliefs

Formulated alternative ideas – collective approach. Refreezing involves creating supportive norms and making changes congruent with personalities within the group (Weick & Quinn, 1999). Refreezing that embeds the new ideas and forestalls relapse is most likely to occur when the idea fits both the personalities of the target and the relational expectations of the project team (Weick & Quinn, 1999). The change process becomes a sequence of events in which a person (a) determines or defines what currently exists, (b) determines or defines its replacement, (c) engages in action to remove what is currently there, and (d) implants its replacement" (Ford & Ford, 1994, p. 773). Beer, Eisenstat and Spector (1990) highlight refreezing is difficult as the replacement of one idea with another restricts change to either-or thinking. Even in project settings, integrating new ideas seems challenging simply because belief is a powerful sentiment and sometimes this 'faith' can be so hard to kill (Royer, 2003). According to a final year business student who did a PBL project:

> "We learnt to listen to others' ideas as we were always mindful that there are no perfect answer to open problems."

Another Finance student mentioned:

> "The whole brainstorming process took around three to four weeks. In the end we came up with a solid idea after we conducted extensive research."

Implemented influence tactics to ensure 'buy-in'. According to a project sponsor:

> "Most of the group members wanted to go with a big idea, and one of our four ideas was also quite bold. But I informed the students that there were

issues that came with big bold ideas that a SME would be concerned about. So in the end the students decided to look for a more implementable, more practical and feasible idea."

Students' comments:

"We presented some countries had adopted similar ideas. This helped to benefit our project in general and in ways we could not imagine. With the evidence, we became more persuasive when negotiating with project sponsor."

"We made a lot of efforts to understand each other's point of view of analysis on same issues by seeing through their lens on these issues."

"Our clients did not know what they wanted hence it's extremely critical for constant communication to gather feedback from the client as soon as you have any working prototype."

Overall in such PBL courses, students were aware that the commitment of the project mates and full support from instructor held the key to success of seeking alternative ideas in the project. Groups should encourage a cohesive culture by gathering ideas and opinions from project members and other project stakeholders. With an open and forgiving culture, project group members were open about their misperceptions. Project lead or instructors also promoted teamwork by gathering the whole team to brainstorm for alternative ideas. By adopting a consultative approach towards devising alternative ideas, project lead or instructors could help to legitimize new ideas by making it a joint decision among the project members – a refreezing process. Furthermore, an analysis was often performed to identify project members' expectations toward any new idea. Several influence tactics were employed to influence the stakeholders in overcoming the commitment to existing course of action and persuade project members to accept alternative ideas. The finding concurs with previous research which notes

that direct appeals to internal and external stakeholders may be needed to negotiate and implement an alternative course of action. Table 1 summarizes the three stages of learning transformation identified in PBL projects at UNI-X and the respective actions taken.

Insert Table 1

Implications, Limitations and Conclusions

This paper presents a learning transformation framework for analyzing the change process of how learners experiment new ideas, explore alternative ideas and eventually come to a consensus to accept new ideas during PBL in a collaborative project environment. By drawing upon a case study of UNI-X, we argue that unfreezing beliefs of previous ideas is critical if alternative ideas are to be developed. It is clear that the entire process of 'unfreezing-changing-refreezing' has occurred in the PBL courses at UNI-X, and enacted through *unfreezing beliefs in previous ideas*, *changing previous beliefs*, and *refreezing the new beliefs*. Through interviews with students, instructors and project sponsors in the PBL courses, we gathered data to examine how project members could give up previous ideas and accept alternative ideas.

While the case study approach adopted here may have several strengths, two major limitations were found in this study. First, the use of 'change management' metaphors in this paper may have implied that change is seen as necessarily desirable and inevitable, but in fact it is contingent and contested. Second, the Lewin's metaphor may be too static and mechanistic for today's fast-changing project environments (Beer & Nohria, 2000).

For researchers and practitioners, the learning transformation framework has several important implications. For researchers, this paper makes a significant contribution by providing a process perspective to examine learning transformation during PBL process. This is a major contribution to PBL literature, as little is known about the dynamics of learning

during PBL process. In fact, the learning transformation framework can serve as the basis for further research in PBL process.

For educators, this study provides them with useful insights on how to break project members' escalating commitment to previous failing ideas and accept alternative workable ideas. Educators can utilize the framework in post-mortem analyses of projects to devise useful actions for facilitating learning transformation during PBL process. In particular, this shows how actions can be deployed to ensure that the learning transformation process is smoothly facilitated. Finally, while this study represents an important step toward understanding learning transformation process, longitudinal field studies that involve multiple case studies are clearly called for, to reflect the diversity of learning change dynamics. Future studies may also compare the effectiveness of the actions taken in the learning transformation framework against other learning interventions.

References

Activate Learning. (2015). IQWST. Retrieved from www.activatelearning.com. Accessed on March 2, 2015.

Aslan, S. and Reigeluth, C.M. (December 2015/January 2016). Examining the challenges of learner-centered education. Kappan Magazine, 97 (4), 63-68.

Barron, B., & Darling-Hammond, L. (2008). *Powerful Learning: What We Know About Teaching for Understanding*. San Francisco, CA: Jossey-Bass.

Beer, M., Eisenstat, R. & Spector, B. (1990). *The Critical Path to Corporate Renewal*. Harvard Business School. Boston: MA.

Beer, M., Eisenstat, R. & Spector, B. (1990). *The critical path to corporate renewal*. Boston, MA: Harvard Business School Press.

Bell, S. (2010). Project-based learning for the 21st century: skills for the future. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas, 83(2)*, 39-43.

Buck Institute for Education (BIE). (2015). PBL essential elements checklist. Retrieved from www.bie.org. Accessed on June 6, 2015.

Cole, K. A., Barker, L. R., Kolodner, K., Williamson, P., Wright, S. M., & Kern, D. E. (2004). Faculty development in teaching skills: An intensive longitudinal model. *Academic Medicine, 79*(5), 469–480.

Creghan, C., and Adair-Creghan, K. (2015). The positive impact of project-based learning on attendance of an economically disadvantaged student population: A multiyear study. Interdisciplinary Journal of Problem-Based Learning, 9 (2). Available at: http://dx.doi.org/10.7771/1541-5015.1496.

Devlin, M. (2008). Proceedings from Universitas 21 Conference: *An international and interdisciplinary approach to curriculum: The Melbourne model*. Glasgow University, Scotland.

Dewey, J. (1938). *Experience and Education*. New York, NY: Macmillan.

Edutopia. (2015). Project-based learning. Retrieved from www.edutopia.org. Accessed on June 24, 2015.

Eggen, P., Kauchak, D. (2007). *Educational psychology: Windows on classrooms*. United States of America, US: Prentice Hall.

Ertas, A., Maxwell, T., Rainey, V. P., & Tanik, M. M. (2003). Transformation of higher education: The transdisciplinary approach in engineering. *IEEE Transactions on Education*, *46(2)*, 289-295.

Ford, J. & Ford, L. (1994). Logics of identity, contradiction, and attraction in change. *Academy Management Review*, *19*, 756-785.

Gultekin, M. (2005). The effect of project based learning on learning outcomes in the 5th grade social studies course in primary education. *Educational Sciences: Theory and Practice*, *5(2)*, 548-556.

Heng, C., Tan, B. & Wei, K. (2003). De-escalation of commitment in software projects: who matters? What matters? *Information & Management*, *41(1)*, 99-110.

Hinsz, V. B., Tindale, R. S., & Vollrath, D. A. (1997). The emerging conceptualization of groups as information processors. *Psychological Bulletin*, *121*, 43–64.

Huber, G. & Glick, W. (1993). *Organizational change and rredesign*. New York, NY: Oxford University Press.

Lee, J.S., Blackwell, S., Drake, J. & Moran, K.A. (2014). Taking a leap of faith: redefining teaching and learning in higher education through project-based learning. *Interdisciplinary Journal of Problem-based Learning*, *8(2)*, Article 2.

Lewin, K. (1951). *Field Theory in Social Science*. New York, NY: Harper and Row.

Markham, T., Larmer, J. & Ravitz, J. (2003). *Project based learning handbook: A guide to standards-focused project based learning* (2nd Ed.). Novato, CA: Buck Institute for Education.

Marks, M.A., Mathieu, J.E. & Zaccaro, S.I. (2001). A temporally based framework and taxonomy of team processes. *Academy of Management Review*, *26(3)*, 356-376.

Mergendoller, J. R., Maxwell, N. L., and Bellisimo, Y. (2006). The effectiveness of problem-based instruction: a comparative study of instructional methods and student characteristics. *Interdisciplinary Journal of Problem-Based Learning*, *1(2)*, Article 5.

Oakley, B., Felder, R. M., Brent, R., & Elhajj, I. (2004). Turning student groups into effective teams. *Journal of Student-Centred Learning*, *2(1)*, 9–34.

Parker, W., Mosborg, S., Bransford, J. Vye N., Wilkerson, J. & Abbott, R. (2011). Rethinking advanced high school coursework: tackling the depth/breadth tension in the AP US government and politics course. *Journal of Curriculum Studies*, *43(4)*, 533-559.

Prochaska, J., DiClemente, C., & Norcross, J. (1992). In search of how people change: applications to addictive behaviors. *American Psychologist*, *47(9)*, 1002-1114.

Raghavan, K., Coken-Regev, S., & Strobel, S. A. (2001). Student outcomes in a local systemic change project. *School Science and Mathematics*, *101(8)*, 24-42.

Repko, A.F. (2008). Assessing interdisciplinary learning outcomes, *Academic Exchange Quarterly*, Fall, 171-178.

Rotherham, A. J., & Willingham, D. T. (2010). "21st-century" skills. *American Educator*, *34*, 17- 20.

Royer, I. (2003). Why bad projects are so hard to kill? *Harvard Business Review*, February, 49-56.

Schein, E. (1988). *Organizational psychology*. Eaglewood Cliffs, NJ: Prentice Hall.

Schein, E. (1996). Kurt Lewin's change theory in the field and in the classroom: notes toward a model of managed learning. *System Practice*, 9, 27-47.

Schwartz, M. (2013). *Best practices in experiential learning*. Eaglewood Cliffs, NJ: Prentice Hall.

Shepherd, D. (2003). Learning from business failure: propositions for grief recovery for the self-employed. *Academy of Management Review*, *28(2)*, 318-328

Silva, E. (2009). Measuring skills for 21st century learning. *Phi Delta Kappan*, *90*, 630-634.

Spreitzer, G. & Quinn, R. (1996). Empowering middle managers to be transformational leaders. *Journal of Applied Behavioural Science*, *32(3)*, 237-261.

Teger, A. (1980). *Too much invested to quit*. New York, NY: Pergamon,

Weick, K. & Quinn, R. (1999). Organizational change and development. *Annual Review Psychology*, *50*, 361-386.

Zhou, J. (2012). The effects of reciprocal imitation on teacher–student relationships and student learning outcomes. *Mind, Brain and Education*, *6(2)*, 66-73.

Figure 1

A Learning Transformation Framework (Adapted from Lewin, 1951)

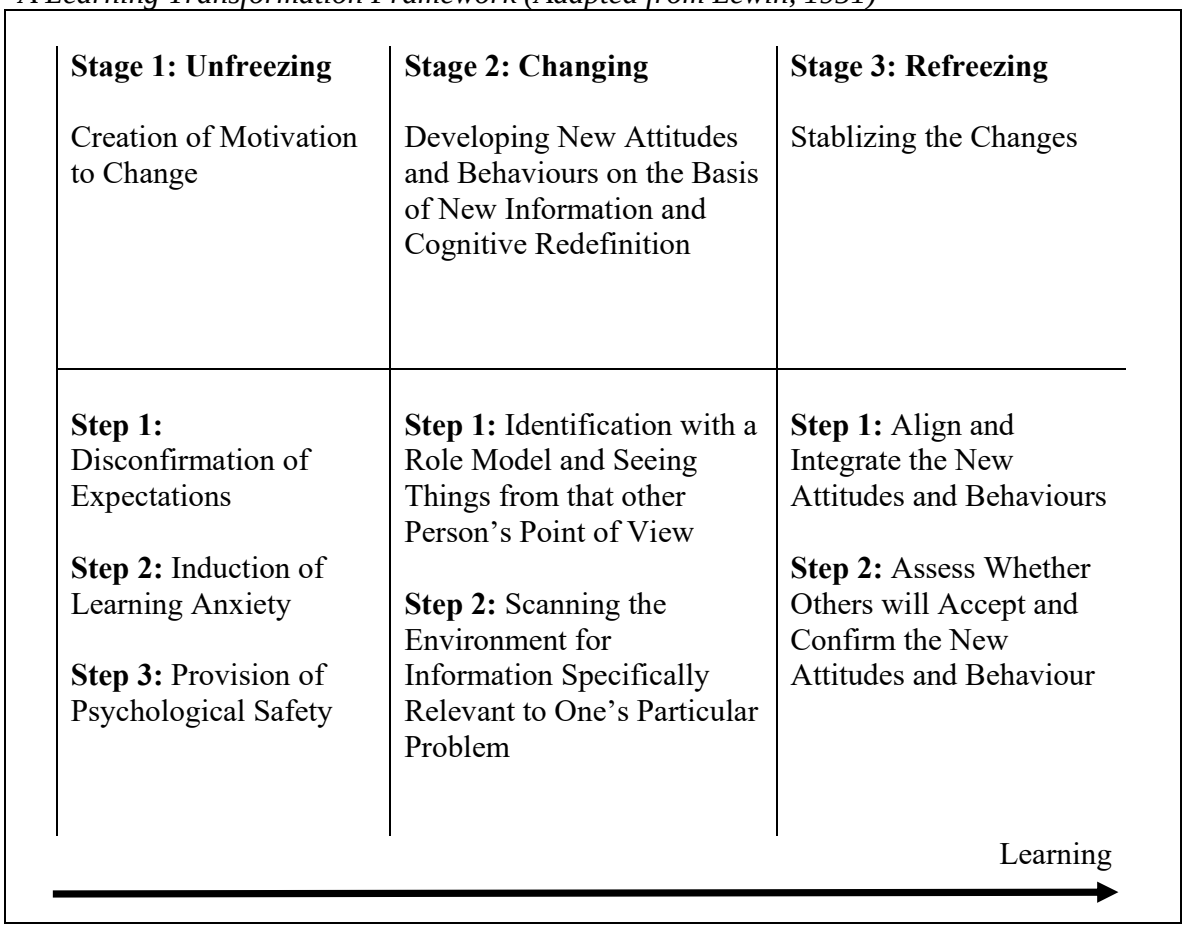

Table 1

Summary of the Three Stages in Learning Transformation Identified in PBL Projects at UNI-X and the Respective Actions Taken

Stage	**Description**	**Actions Taken**
Unfreezing Belief in Previous Ideas	Unfreezing involves three processes: (a) disconfirmation of expectations, (b) induction of learning anxiety if the disconfirming data are accepted as valid and relevant, and (c) provision of psychological safety that converts anxiety into motivation to change.	Identified expectation gaps in projects among students, faculty and project sponsor.
		Undertaken intervention to induce anxiety and discomfort to challenge the strong belief.
		Provided assurance and support.
Changing Previous Beliefs	Identified with a change agent and scan the environment for information.	Instructor introduced cognitive restructurings and semantic redefinitions.
		Consulted various stakeholders to explore ideas.
		Scanned the environment for information.
Refreezing New Beliefs	Align and integrate new beliefs and assess whether the beliefs are 'bought in'.	Formulated alternative ideas – collective approach.
		Implemented influence tactics to ensure 'buy-in'.